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Sarah J. Knight, Patent Attorney

REQUEST FOR CERTIFICATE OF CORRECTION UNDER 37 CFR 1.322 and 1.323
Docket No. UF.311XC1
Patent No. 7,474,657 B2

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

| | | |
|---|---|---|
| Applicants | : | Sartaj Kumar Sahni, Haibin Lu, Kun Suk Kim |
| Issued | : | January 6, 2009 |
| Patent No. | : | 7,474,657 B2 |
| Conf. No. | : | 1937 |
| For | : | Partitioning Methods For Dynamic Router Tables |

ATTN: CERTIFICATE OF CORRECTION BRANCH
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

REQUEST FOR CERTIFICATE OF CORRECTION UNDER 37 CFR 1.322 (OFFICE MISTAKE) AND UNDER 37 CFR 1.323 (APPLICANTS' MISTAKE)

Sir:

A Certificate of Correction for the above-identified patent has been prepared and is attached hereto.

In the left-hand column below is the column and line number where errors occurred in the patent. In the right-hand column is the page and line number in the application where the correct information appears.

| **Patent Reads:** | **Application Should Read:** |
|---|---|
| Column 2, Line 57:<br>"O(W long n)" | Page 3, Line 26:<br>-- O(W log n)-- |
| Column 2, Line 60:<br>" O(W+long n)" | Page 3, Line 28:<br>-- O(W + log n)-- |
| **Patent Reads:** | **Application Reads:** |
| Column 8, Line 57:<br>"$\Sigma_{j=0}{}^{i}s_j$" | Page 13, Line 9:<br>-- $\sum_{j=0}^{l} s_j$ -- |
| **Patent Reads:** | **Application Should Read:** |
| Column 10, Line 63:<br>"to keep tack of" | Page 16, Line 5:<br>--to keep track of-- |
| **Patent Reads:** | **Application Reads:** |
| Column 11, Line 21:<br>"II. Interval Partitioning According to the" | Page 16, Line 25:<br>--II. Interval Partitioning According to the-- |
| **Patent Reads:** | **Application Should Read:** |
| Column 11, Line 53:<br>"r4=16,18], r5=18,19]" | Page 17, Line 14:<br>-- r4=[16,18], r5=[18,19]-- |
| Column 12, Line 21:<br>"TLPD[i]" | Page 18, Line 12:<br>--TLDP[i]-- |

A true and correct copy of pages 13 and 16 of the specification as filed, which supports Applicants' assertion of errors on the part of the Patent Office, accompanies this Certificate of Correction.

The Commissioner is authorized to charge the fee of $100.00 for the amendment to Deposit Account No. 19-0065. The Commissioner is also authorized to charge any additional fees as required under 37 CFR 1.20(a) to Deposit Account No. 19-0065.

Approval of the Certificate of Correction is respectfully requested.

Respectfully submitted,

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SJK/jlr
Attachments: Copy of pages 13 and 16 of the specification
Certificate of Correction

table, the range is mapped and transformed as described above, and the transformed range is inserted into the PST. To delete a prefix, the transformed range is removed from the PST. When the PST is an RBPST, each search, insert, and delete action is performed in $O(\log n)$ time.

Example 1– OLDP and TLDP application to fixed-stride tries

A trie node whose stride is $s$ has $2^s$ subtries, some or all of which may be empty. A fixed-stride trie (FST) is a trie in which all nodes that are at the same level have the same stride. The nodes at level $i$ of an FST store prefixes whose length, *length(i)*, is $\sum_{j=0}^{i} s_j$, where $s_j$ is the stride for nodes at level $j$. In certain instances, the present invention provides for the expansion of a prefix with a nonpermissible length to the next permissible length. In such instances, where a newly created prefix is a duplicate, natural dominance rules are applied to eliminate all but one occurrence of the prefix. Because duplicate prefixes are eliminated from the expanded prefix set, all prefixes are distinct.

By way of example, a set of prefixes is represented on an FST that has three levels, wherein the strides are 3, 2, and 2. The root of the trie stores prefixes whose length is 3; the level one nodes store prefixes whose length is 5 (3 + 2); and the level two nodes store prefixes whose length is 7 (3 + 2 + 2). This poses a problem for prefixes in which the length is different from the storeable length. For instance, suppose the length of a prefix is 2. In accordance with the present invention, the length of the prefix can be expanded to the next permissible length. For example, as illustrated in Figure 6A, P3 = 11* is expanded to P3a = 110* and P3b = 111*. If one of the newly created prefixes is a duplicate, natural dominance rules are used to eliminate all but one occurrence of the prefix. For instance, P7 = 110000* is expanded to P7a = 1100000* and P7b = 1100001*. However, P8 = 1100000* is to be chosen over P7a = 1100000*, because P8 is a longer match than P7. So P7a is eliminated. Because the elimination of duplicate prefixes from the expanded prefix set, all prefixes are distinct. Figure 6B shows the prefixes that result when the prefixes of Figure 6A are expanded to lengths 3, 5, and 7. Figure 7 illustrates the corresponding FST whose height is 2 and whose strides are 3, 2, and 2.

prefixes inserted at node $M$. When prefix $p$ is inserted, $N.prefixes[q]$ is set to true. $q$ is $2^{length(p)-length(i-1)} + number(i,p) - 2$, where $(i,p)$ is a number represented by bits $length(i-1)...length(p)-1$ of $p$ (the bits of $p$ are indexed from left to right beginning with the index 0). For example, the bit-sequence 010 represents the number 2. An alternative to the array $M.prefixes[\ ]$ is to keep tack of the prefixes inserted at node $M$ using a trie on bits $length(i-1)...$ of the inserted prefixes.

To delete the prefix $p$, the node $N$ is identified in the same fashion as that for an insertion operation described above. $N.prefixes[q]$ is set to false, where $q$ is computed as described above. To update the prefix slots of $N$ that contain $p$, the longest proper prefix of $p$ that is in $N.prefixes$ is identified. This longest proper prefix is determined by examining $N.prefixes[j]$ for $j = 2^{r-length(i-1)} + \text{number } (i,p_r) - 2$, $r = length(p) - 1$, $length(p) - 2$, ..., $length(i-1) + 1$, where $p_r$ is the first $r$ bits of $p$. The examination stops at the first $j$ for which $N.prefixes[j]$ is true. The corresponding prefix replaced $p$ in the prefix slots of $N$. If there is no such $j$, the null prefix replaces $p$.

Since the root stride is 16, for the recommended IPv4 FSTs (16-4-4-8, 16-4-4-4-4, and 16-8-8) and since $s = 16$ is recommended for IPv4, by way of example, an OLDP 16-4-4-4-4 FST has the structure shown in Figure 1 with each $OLDP[i]$, $i \geq 0$ being a 4-4-4-4 FST; $OLDP[-1]$ is a 4-4-4-3 FST. The root of each 4-4-4-4 FST, while having a stride of 4, needs to account for prefixes of length 16 through 20.

In contrast, a TLDP 16-4-4-4-4 FST has the structure of Figure 4 with each $OLDP[i]$, $i \geq 0$ being a 4-4-4-4 FST; each $TLDP[i]$, $i \geq 0$ is a 4-3-FST; and $TLDP[-1]$ is a 4-3-FST. The root of each $TLDP[i]$ 4-3-FST, while having a stride of 4, needs to account for prefixes of length 8 through 12.

II. Interval Partitioning

According to the present invention, interval partitioning requires prefixes be represented as a range. The end points of the ranges are then ordered, wherein two consecutive endpoints define an interval (also called a "basic interval"). Using interval-based routing table data structures, the interval partitioning scheme of the present invention

# UNITED STATES PATENT AND TRADEMARK OFFICE

# CERTIFICATE OF CORRECTION

PATENT NO. : 7,474,657 B2 

APPLICATION NO.: 10/718,842

DATED : January 6, 2009

INVENTORS : Sartaj Kumar Sahni, Haibin Lu, Kun Suk Kim

It is certified that errors appear in the above-identified patent and that said Letters Patent is hereby corrected as shown below:

Column 2,
Line 57, "O(W long n)" should read --O(W log n)--.
Line 60, "O(W+long n)" should read --O(W + log n)--.

Column 8,
Line 57, "$\Sigma_{j=0}^{i} s_j$" should read -- $\sum_{j=0}^{i} s_j$ --.

Column 10,
Line 63, "to keep tack of" should read --to keep track of--.

Column 11,
Line 21, "II. Interval Partitioning According to the" should read
--II. Interval Partitioning
According to the--.

Line 53, "r4=16,18], r5=18,19]" should read --r4=[16,18], r5=[18,19]--.

Column 12,
Line 21, "TLPD[i]" should read --TLDP[i]--.

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